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JC849 U.S. PTO

PATENT
Docket No. 4072-4001
Express Mail Label No. EK784973475US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

UTILITY APPLICATION AND APPLICATION FEE TRANSMITTAL (1.53(b))

COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

JC836 U.S. PTO
09/595038
06/15/00

Sir:

Transmitted herewith for filing is the patent application of

Named Inventor(s) and Address(es): Laszlo VALASZKAI, Malarevagen 15, 294 38 Solvesborg, Sweden
Esad CELIK, Hjortakrocksvagen 1J, 294 39 Solvesborg, Sweden

For: FLUID CONVEYING TUBE AND VEHICLE COOLER PROVIDED THEREWITH

Enclosed are:

[X] 11 page(s) of specification, 1 page(s) of Abstract, 3 page(s) of claims

[x] 3 sheets of drawing [x] formal [] informal

[x] 6 page(s) of Declaration and Power of Attorney

- [x] Unsigned
- [] Newly Executed
- [] Copy from prior application

[] Deletion of inventors including Signed Statement under 37 C.F.R. § 1.63(d)(2)

[] Incorporation by Reference: The entire disclosure of the prior application, from which a copy of the combined declaration and power of attorney is supplied herein, is considered as being part of the disclosure of the accompanying application and is incorporated herein by reference.

[] Microfiche Computer Program (Appendix)

[] page(s) of Sequence Listing

- [] computer readable disk containing Sequence Listing
- [] Statement under 37 C.F.R. § 1.821(f) that computer and paper copies of the Sequence Listing are the same

[x] Claim for Priority

[x] Certified copy of Priority Document(s)

09595038 061500

- ☐ English translation documents
- ☒ Information Disclosure Statement
- ☒ Copy of 5 cited references
- ☐ Copy of PTO-1449 filed in parent application serial No. _____.
- ☒ Preliminary Amendment
- ☒ Return receipt postcard (MPEP 503)
- ☐ Assignment Papers (assignment cover sheet and assignment documents)
- ☐ A check in the amount of \$40.00 for recording the Assignment.
- ☐ Assignment papers filed in parent application Serial No. _____.
- ☐ Certification of chain of title pursuant to 37 C.F.R. § 3.73(b).
- ☐ This is a ☐ continuation ☐ divisional ☐ continuation-in-part (C-I-P) of prior application serial no. _____.
- ☐ Cancel in this application original claims _____ of the parent application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
- ☐ A preliminary Amendment is enclosed. (Claims added by this Amendment have been properly numbered consecutively beginning with the number following the highest numbered original claim in the prior application.
- ☐ The status of the parent application is as follows:
- ☐ A Petition For Extension of Time and a Fee therefor has been or is being filed in the parent application to extend the term for action in the parent application until _____.
- ☐ A copy of the Petition for Extension of Time in the co-pending parent application is attached.
- ☐ No Petition For Extension of Time and Fee therefor are necessary in the co-pending parent application.
- ☐ Please abandon the parent application at a time while the parent application is pending or at a time when the petition for extension of time in that application is granted and while this application is pending has been granted a filing date, so as to make this application co-pending.
- ☐ Transfer the drawing(s) from the patent application to this application.
- ☐ Amend the specification by inserting before the first line the sentence:
This is a ☐ continuation ☐ divisional ☐ continuation-in-part of co-pending application Serial No. _____
_____ filed _____.

I. CALCULATION OF APPLICATION FEE (For Other Than A Small Entity)

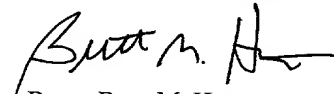
	Number Filed		Number Extra	Rate	Basic Fee
Total Claims	14	-20=	0	x\$18.00	\$ 0
Independent Claims	1	- 3=	0	x\$78.00	\$ 0
Multiple Dependent Claims	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no				Additional Fee = \$260.00 Add'l Fee = NONE

Total: \$ 690.00

- ☐ A statement claiming small entity status is attached or has been filed in the above-identified parent application and its benefit under 37 C.F.R. § 1.28(a) is hereby claimed. Reduced fees under 37 C.F.R. § 1.9(F) (50% of total) paid herewith \$ _____.
- ☒ A check in the amount of \$ 690.00 in payment of the application filing fees is attached.
- ☐ Charge Fee(s) to Deposit Account No. 13-4500. Order No. _____. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.
- ☐ The Assistant Commissioner is hereby authorized to charge any additional fees which may be required for filing this application, or credit any overpayment to Deposit Account No. 13-4500, Order No. 4072-4001. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

Respectfully submitted,

MORGAN & FINNEGAN, L.L.P.


 By: Brett M. Hutton
 Registration No. P-46,787
Dated: June 15, 2000

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FORM: UTL-TRAN.NY
 Rev. 12/29/99

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : VALASZKAI, et al Group Art Unit:
Serial No. : Examiner:
Filed :
For : FLUID CONVEYING TUBE AND VEHICLE COOLER
PROVIDED THEREWITH



EXPRESS MAIL CERTIFICATE

Express Mail Label No. EK784973475US

Date of Deposit June 15, 2000

I hereby certify that the following attached paper(s) and/or fee

1. Utility Application and Application Fee
2. Claim to Convention Priority w/document
3. Information Disclosure Statement w/5 references
4. preliminary amendment

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under

37 C.F.R. §1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents,

Washington, D.C. 20231.

Albert Isles

(Typed or printed name of person
mailing paper(s) and/or fee)

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Application Information

Title Line One :: FLUID CONVEYING TUBE AND VEHICLE
Title Line Two :: COOLER PROVIDED THEREWITH
Total Drawing Sheets :: 3
Formal Drawings :: Y
Application Type :: Utility
Docket Number :: 4072-4001

Representative Information

Registration Number One :: 28,287

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PATENT
Docket No. 4072-4001
Express Mail Label No. EK784973475US

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : VALASZKAI, et al

Group Art Unit : Examiner:

Serial No. :

Filed :

15 For : FLUID CONVEYING TUBE AND VEHICLE COOLER
PROVIDED THEREIN

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, please amend claim 14
as follows:

14. (amended) A vehicle cooler comprising a heat
exchanger assembly and at least one tank connected to the heat
exchanger assembly, wherein the heat exchanger assembly
comprises fluid conveying tubes according to [any one of claims
1-13] claim 1 and surface enlarging means arranged between the
tubes.

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REMARKS

Claim 14 has been amended to eliminate multiple dependency.
No new matter was added to the application as a result of this
amendment.

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The Commissioner is hereby authorized to charge any
additional fees which may be required for this amendment, or
credit any overpayment to Deport Account No. 13-4500, Order No.
4072-4001. A DUPLICATE COPY OF THIS SHEET IS ATTACHED.

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Respectfully submitted,
MORGAN & FINNEGAN, L.L.P.

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Dated: June 15, 2000

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UNITED STATES PATENT APPLICATION

OF

LASZLO VALASZKAI

AND

ESAD CELIK

FOR

FLUID CONVEYING TUBE AND VEHICLE COOLER

PROVIDED THEREWITH

Technical Field

The present invention generally relates to vehicle coolers, and in particular to the design of fluid conveying tubes included in such coolers.

Background Art

One type of vehicle cooler, which is, for instance, disclosed in EP-A1-0 590 945, comprises a heat exchanger assembly which is made up of, on the one hand, flat fluid conveying tubes, which are juxtaposed to be passed by a first fluid, for instance, liquid circulating through an engine block and, on the other, surface-enlarging means arranged between the tubes and adapted to be passed by a second fluid, e.g. cooling air. Each tube has opposite large faces, to which the surface-enlarging means are applied and which form the primary heat exchanging surfaces of the tube.

In this type of coolers, it is already known to provide the primary surfaces on the inside of the tubes with projections with a view to increasing the heat exchange between the fluids. These projections break up the insulating, laminar boundary layer which otherwise tends to form inside the tube along its primary surfaces, at least at low fluid flow rates. The projections can be elongate, as known from e.g. US-A-4,470,452, or cylindrical, as known from e.g. US-A-5,730,213. However, these constructions are not capable of combining a sufficiently high heat exchanging capacity with a sufficiently low pressure drop in the longitudinal direction of the tubes.

An alternative embodiment of fluid conveying tubes is disclosed in a doctor's thesis published in 1997 by Chalmers Institute of Technology entitled "Thermal and hydraulic performance of enhanced rectangular tubes for compact heat exchangers". Such a tube is schematically

shown in a plan view in Fig. 1. The opposite primary surfaces of the tube have transverse ribs 1 in zigzag, i.e. surface structures which each consist of a number of elongate rib elements 2 which are connected to each other in intermediate pointed areas 3. The transverse ribs 1 are alternately arranged in the longitudinal direction L of the tube on the opposite primary surfaces of the tube, the ribs 1 (full lines in Fig. 1) arranged on the upper primary surface being transversely offset relative to the ribs 1 (dashed lines in Fig. 1) arranged on the lower primary surface. Seen in the longitudinal direction L of the tube, the succeeding rib elements 2 are arranged alternately on the opposite primary surfaces and have a given mutual angle. Thus, the rib elements 2 will direct the flow of the first fluid through the tube to generate a swirling motion about the longitudinal axis of the tube, as schematically shown in the end view in Fig. 2. More specifically, the input flow is divided into a number of parallel partial flows 4 to which a spiral motion is imparted when passing through the tube, each partial flow 4 having an opposite rotation relative to the adjoining partial flows 4. By means of such partial flows, the boundary layer adjacent to the primary surfaces is broken up and a better circulation of fluid is provided between the centre portions and wall portions of the tube. All this results in a potentially high heat exchanging capacity of the tube. It has, however, been found that it is difficult to provide connected ribs in zigzag shape by means of today's manufacturing technique, and therefore there is in practice a gap in the pointed areas 3 between the rib elements 1.

Vehicle coolers with this type of "spiral-flow tubes" have been found to have a high heat exchanging

capacity also at relatively small flows through the tubes, which is often desirable, for instance, in vehicle coolers for truck engines with air charging or boosting, since these vehicles can generate large quantities of heat also at low speeds of the engine.

The above construction is, however, in its infancy, and needs to be further developed to optimise its capacity.

Summary of the Invention

It is an object of the present invention to provide an improved fluid conveying tube, i.e. a tube which for a given size has a higher capacity of heat exchange and/or a lower pressure drop than ordinary constructions, in particular when relatively small fluid flows are passing through the same.

It is also an object to provide a fluid conveying tube with a small risk of clogging.

Yet another object is to provide a fluid conveying tube which is simple to manufacture.

These and other objects, which will appear from the description below, have now completely or partially been achieved by means of a fluid conveying tube and a vehicle cooler according to appended claims 1 and 13, respectively. Preferred embodiments are defined in the dependent claims.

The inventive construction divides an input fluid flow into a number of partial flows and a swirling motion about a respective axis extending in the longitudinal direction of the tube is imparted to each partial flow. Thanks to the fact that the elongate directing elements in the surface structures are placed in rows which extend laterally over the tube and that the directing elements included in the respective rows are mutually parallel,

the directing elements can be packed closer to each other than in previous constructions. As a result, more partial flows can be obtained in the tube for a given width of the primary surfaces of the tube. This has been found to result in a higher heat exchanging capacity than in previous constructions, in particular at small fluid flows through the tube. The inventive tube can easily be provided with suitable directing elements, for instance, by embossing a blank to form elongate recesses or pits in the large faces of the tube.

Brief Description of the Drawings

Below, the invention and its advantages will be described in more detail with reference to the accompanying schematic drawings, which by way of example, show presently preferred embodiments of the invention.

Figs 1-2 are a plan view and an end view, respectively, of a fluid conveying tube according to prior-art technique.

Figs 3-8 are different views of a fluid conveying tube according to the invention, Fig. 3 being an end view thereof, Fig. 4 being a plan view of a part thereof, Fig. 5 being a sectional view along the line V-V in Fig. 4, Fig. 6 being a longitudinal sectional view along the line VI-VI in Fig. 4, and Figs 7-8 being transverse sectional views along the line VII-VII and VIII-VIII, respectively, in Fig. 4.

Figs 9-10 are an end view and a plan view, respectively, of an inventive fluid conveying tube of dual-channel type.

Description of Preferred Embodiments

Figs 3-8 show a preferred embodiment of a fluid conveying tube 10 according to the invention. The tube 10 is suitably made of a metal material, usually an alumi-

niun material. As appears from Fig. 3, the tube 10 is flat and has two opposite large faces 11, 12, which are substantially plane. The large faces 11, 12 are connected via two opposite, curved short sides 13, 14. When the tubes 10 are mounted in a vehicle cooler, surface-enlarging means (not shown), for instance folded laminae, are brought into abutment against the large faces 11, 12. The principal heat exchange between the medium flowing through the tubes 10 and the medium flowing through the surface-enlarging means about the outside of the tubes 10 thus takes place via these large faces 11, 12. The large faces 11, 12 form two opposite primary heat exchange surfaces 11', 12' on the inside of the tube 10. As appears from Figs 4-8, the primary surfaces 11', 12' are provided with a number of projecting, flow-directing elements 15, which are called dimples, in the form of small pits on one side of the large faces 11, 12 of the tube 10, said pits forming corresponding projections on the opposite side thereof. These dimples can, for instance, be formed by embossing a blank, which is subsequently formed into the flat tube 10. The height F (see Fig. 6) of a dimple 15 is typically about 0.1-0.3 mm, which substantially corresponds to the material thickness of the tube.

The dimples 15 are elongate and inclined relative to the longitudinal direction L of the tube 10. In addition, the dimples 15 are arranged in a number of surface structures or groups 16 on the respective primary surfaces 11', 12'. Fig. 4 shows the dimples 15 on the upper primary surface 11' in full lines and the dimples 15 on the lower primary surface 12' in dashed lines. Below, the groups 16 of dimples 15 on the left-hand side of the centre line C-C of the tube 10 will first be discussed. It is evident from the plan view in Fig. 4 that the

groups 16 of dimples 15 on the upper and lower primary surfaces 11', 12' are relatively offset in the longitudinal direction L, so that the tube 10 in cross-section lacks opposite dimples 15 (see Figs 6-8). This makes it possible to avoid clogging of the tube 10. The groups 16 of dimples 15 are thus alternately arranged on the upper and lower primary surfaces 11', 12' seen in the longitudinal direction L. Each group 16 consists of a first and a second transverse row 17, 18 of inclined dimples 15. Within the respective rows 17, 18 all dimples 15 are mutually parallel. The dimples 15 in the first row 17 are inclined relative to one short side 13 of the tube 10 at an angle α relative to the longitudinal direction L, whereas the dimples 15 in the second row 18 are inclined relative to the second, opposite short side 14 of the tube 10 at an angle β relative to the longitudinal direction L. The dimples 15 in the first row 17 and the dimples 15 in the second row 18 thus have a mutual inclination angle of $\gamma = 180^\circ - \alpha - \beta$. Furthermore, the dimples 15 in the second row 18 are laterally offset relative to the dimples 15 in the first row 17, suitably such that the ends 19 of the dimples 15 in the first row 17, seen in the longitudinal direction L, are located in alignment with the ends 19 of the dimples 15 in the second row 18. Seen in the longitudinal direction L, i.e. in the main flow direction of a fluid through the tube 10, succeeding dimples 15 are alternately arranged on the upper and lower primary surfaces 11', 12', at least along a line through the centre of the dimples 15 (cf. the line VI-VI in Fig. 4). Moreover, such succeeding dimples 15 are mutually inclined at an angle γ .

In a fluid conveying tube according to Figs 3-8, an input flow of a fluid will be divided into a number of partial flows, to which, while directed by the inclined dimples 15, is imparted a swirling motion about a respective axis extending in the longitudinal direction L of the tube 10. Each set of dimples 15 parallel with the longitudinal direction L of the tube 10 thus forms a virtual channel, in which the fluid performs a spiral motion. Thanks to the fact that the dimples 15 in the respective rows 17, 18 are mutually parallel, they can be placed in a compact pattern on the primary surfaces 11', 12' but still form well-defined virtual channels for the input fluid.

In the embodiment according to Figs 3-8, the tube 10 has groups 16 of dimples 15 on both sides of its centre line C-C, but for reasons of manufacture there are no dimples 15 in the area round the actual centre line C-C. The reason for this is that today's manufacturing technique requires the application of an abutment member centrally on the blank during the embossment of the same. Furthermore, in the shown example the dimples 15 in the groups 16 on each side of the centre line C-C are mutually mirror-inverted. It should, however, be noted that the groups 16 can have the same appearance on both sides of the centre line C-C. If admitted by the manufacturing technique, it is actually preferred that the dimples 15 extend continuously transversely of the primary surfaces 11', 12' between the short sides 13, 14. It should, however, be noted that the rows 17, 18 of dimples 15 do not have to extend perpendicularly to the longitudinal direction L of the tube 10, but can also extend obliquely over the surfaces 11', 12'.

It has been found that the dimensioning and positioning of the dimples 15 on the primary surfaces 11', 12' of the tube 10 influence the capacity of the tube 10 as concerns the heat exchanging capacity and pressure drop. Parameters which have been investigated are the angles of inclination α and β of the dimples 10 (see Fig. 4), the distance B between succeeding dimples 10 in the longitudinal direction L (see Fig. 4), the distance C between succeeding dimples 15 on the respective primary surfaces 11', 12' in the longitudinal direction L (see Fig. 4), the height F of the dimples 15 from the primary surfaces 11', 12' (see Fig. 5) and the length A of the dimples 15 (see Fig. 5).

It has then been found that the angles α and β are preferably equal. Furthermore, the angles α and β should be in the range of about 40-80°, and preferably in the range of about 45-75°. Currently, the most preferred value of α and β is about 45°, which means that succeeding dimples are substantially mutually perpendicular.

Furthermore, it has been found that suitably the distance C is twice the distance B, i.e. that all dimples 15 succeeding in the longitudinal direction L of the tube 10 have a constant mutual centre-to-centre distance.

When the tube 10 is to be passed by a fluid in the form of a liquid, e.g. water, the following preferred dimensions have been found. For a liquid flowing through the tube at a mean rate of about 0.8-2.2 m/s, the relation between the distance B and the height F of the dimples 15 should be in the range of about 10-40, and preferably about 15-30. At the minimum limit value, the pressure drop along the tube will be undesirably high, and at the maximum limit value the heat exchanging ca-

capacity through the primary surfaces will be unsatisfactorily low. In a tube 10 having a distance G between the primary surfaces 11', 12' of 0.8-2.8 mm, the relation between the length A of the dimples 15 and height F of the dimples 15 should be in the range of about 4-14. At the minimum limit value, the pressure drop along the tube 10 will be undesirably high, and at the upper limit value the heat exchanging capacity through the primary surfaces 11', 12' will be unsatisfactorily low. Furthermore, the relation between the mutual distance G of the primary surfaces 11', 12' and the height F of the dimples 15 should be at least about 2.5. This is preferred in tubes having a mutual distance between the primary surfaces 11', 12' of 0.8-2.8 mm in order to avoid clogging when a liquid flows through the tube at a mean rate of about 0.8-2.2 m/s.

When the tube is to be passed by a fluid in the form of a gas, e.g. air, it has been found that the relation between the distance B and the height F of the dimples 15 should be in the range of about 25-65, and preferably about 35-55. At the minimum limit value, the pressure drop along the tube will be undesirably high, and at the maximum limit value the heat exchanging capacity through the primary surfaces will be unsatisfactorily low.

Figs 9-10 show an alternative embodiment of a fluid conveying tube. Parts having corresponding parts in Figs 3-4 have the same reference numerals and are not described in more detail. The tube 100 contains two separate fluid ducts or channels 101, 102 which are separated by a partition wall 103. The tube 100 is suitably formed by bending a blank provided with dimples. The pattern of dimples 15 on the large faces 11, 12 of the tube 100 is substantially identical with the pattern on the tube 10

in Fig. 4, and therefore corresponding advantages are achieved.

It should be noted that the inventive tube is applicable to all types of vehicle coolers having tubes arranged in parallel for cooling fluids, i.e. liquids or gases, such as liquid coolers, charge-air coolers, condensers and oil coolers.

What we claim and desire to secure by Letters Patent is:

1. A fluid conveying tube for vehicle coolers, which on its inside comprises first and second opposite longitudinal primary heat exchange surfaces, and flow-directing surface structures which are arranged on the primary surfaces and which each comprise a plurality of elongate directing elements projecting from the primary surfaces, the surface structures being alternately arranged on the first and second primary surfaces in such manner that directing elements, succeeding in the longitudinal direction of the primary surfaces, are alternately arranged on the first and second primary surfaces and are mutually inclined at a given angle (γ), wherein each surface structure comprises a laterally extending first row of mutually parallel directing elements.

2. A fluid conveying tube as claimed in claim 1, wherein at least one end of each directing element in said surface structure is arranged, seen in the longitudinal direction of the primary surfaces, essentially in alignment with one end of another directing element in said surface structure.

3. A fluid conveying tube as claimed in claim 1, wherein each surface structure comprises a laterally extending second row of mutually parallel directing elements, the directing elements of the second row being arranged at said angle (γ) relative to the directing elements of the first row.

4. A fluid conveying tube as claimed in claim 3, wherein at least one end of each directing element of the first row is arranged, seen in the longitudinal direction of the primary surfaces, essentially in alignment with one end of an associated directing element of the second row.

5. A fluid conveying tube as claimed in claim 3, wherein the directing elements are laterally relatively offset in the first and second rows.

6. A fluid conveying tube as claimed in claim 4, wherein the directing elements are laterally relatively offset in the first and second rows.

7. A fluid conveying tube as claimed in claim 1, wherein said angle (γ) is about 20-100°, preferably about 30-90°, and most advantageously about 90°.

8. A fluid conveying tube as claimed in claim 1, wherein said row or rows extend perpendicularly to the longitudinal direction of the primary surfaces.

9. A fluid conveying tube as claimed in claim 1, which is designed to be passed by a liquid, wherein the centre-to-centre distance between directing elements succeeding in said longitudinal direction is about 10-40, and preferably about 15-35, times as large as the height of the directing elements perpendicularly to the primary surfaces.

10. A fluid conveying tube as claimed in claim 1, which is designed to be passed by a gas, wherein the centre-to-centre distance between directing elements succeeding in said longitudinal direction is about 25-65, preferably about 30-55, times as large as the height of the directing elements perpendicularly to the primary surfaces.

11. A fluid conveying tube as claimed claim 1, wherein each elongate directing element has a length which is about 4-14 times as large as its height perpendicularly to said primary surface.

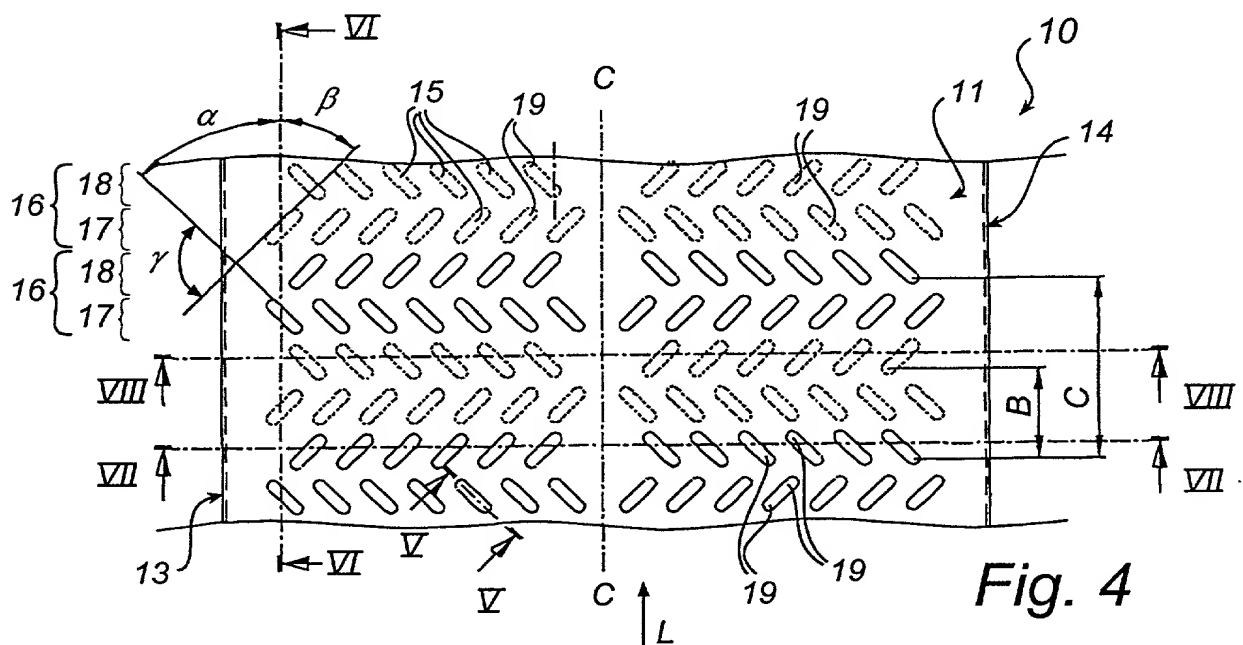
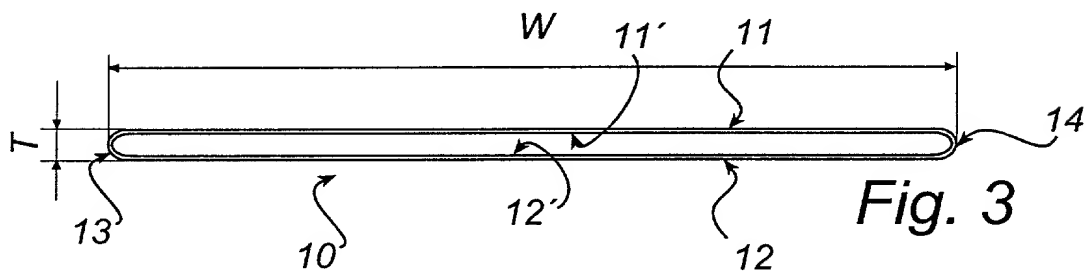
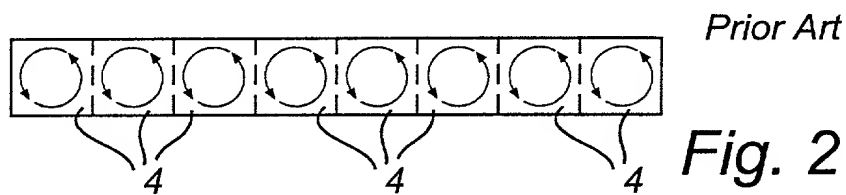
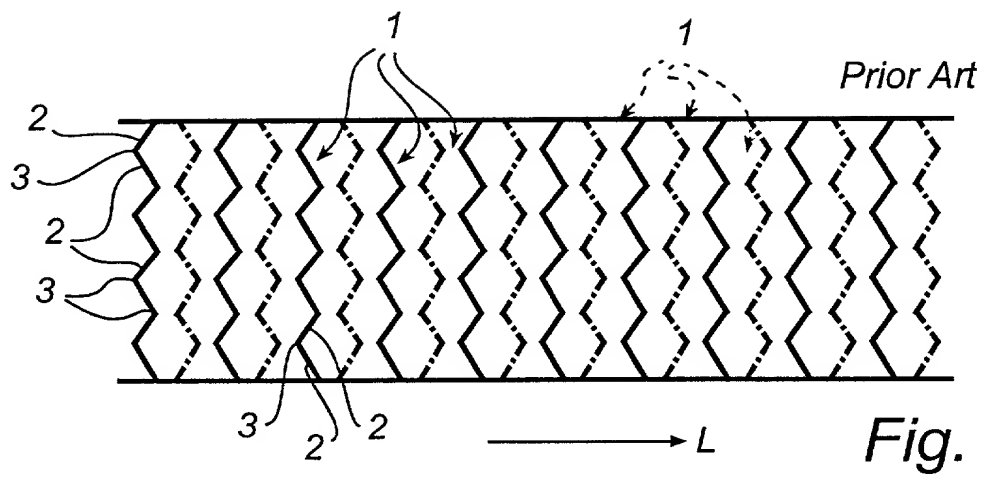
12. A fluid conveying tube as claimed in claim 1, wherein the distance between said primary surfaces is at least about 2.5 times as large as the height of the directing elements perpendicularly to said primary surfaces.

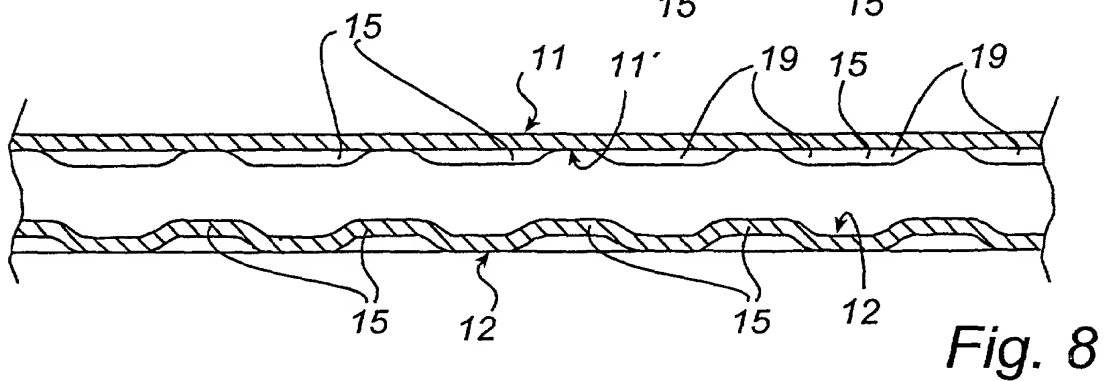
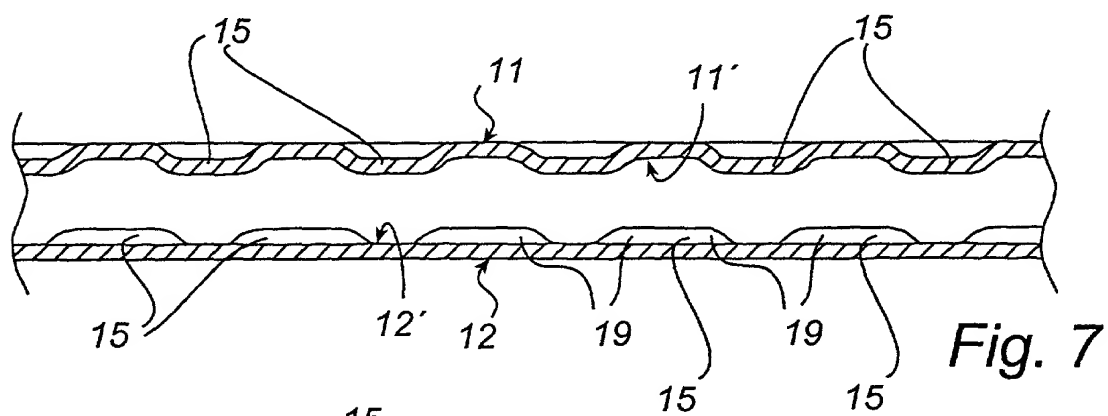
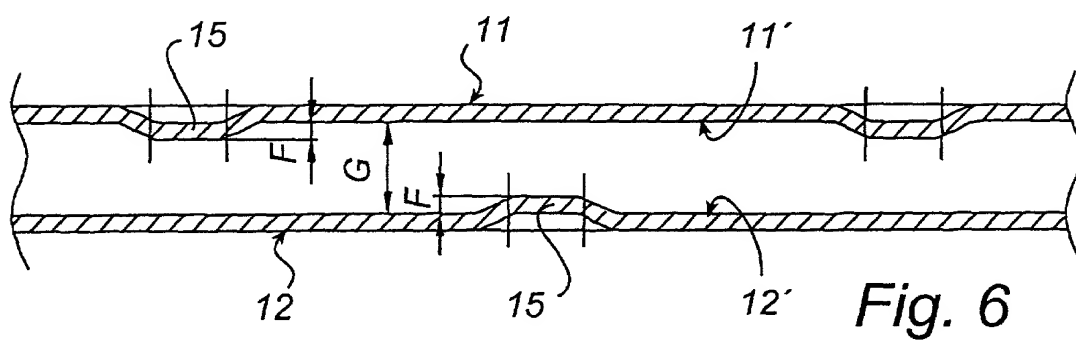
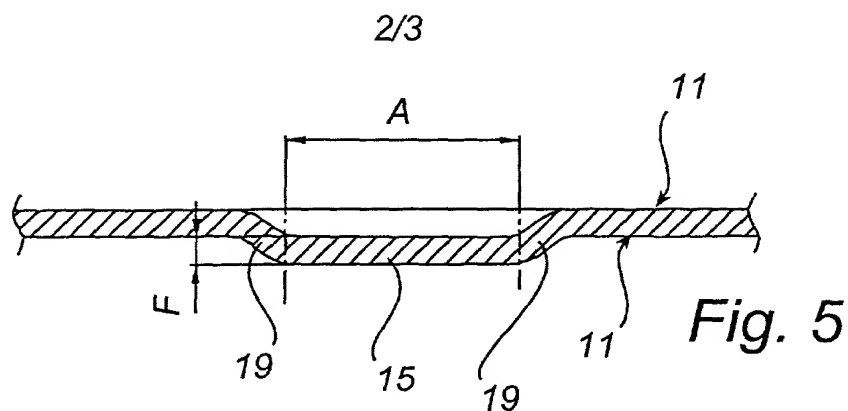
13. A fluid conveying tube as claimed in claim 1, wherein said surface structures are arranged and designed to form a number of parallel flow paths which extend through the tube and in each of which a swirling motion about a respective axis extending in said longitudinal direction is imparted to a fluid flowing through the tube.

14. A vehicle cooler comprising a heat exchanger assembly and at least one tank connected to the heat exchanger assembly, wherein the heat exchanger assembly comprises fluid conveying tubes according to any one of claims 1-13 and surface-enlarging means arranged between the tubes.

Abstract of the Disclosure

A fluid conveying tube included in a vehicle cooler comprises on its inside first and second opposite longitudinal primary heat exchange surfaces, and flow-directing surface structures which are arranged on the primary surfaces. Each surface structure comprises a plurality of elongate directing elements projecting from the primary surfaces. The surface structures are alternately arranged on the first and second primary surfaces in such manner that directing elements, succeeding in the longitudinal direction of the primary surfaces, are alternately arranged on the first and second primary surfaces and are mutually inclined at a given angle (γ). Each surface structure comprises a laterally extending row of mutually parallel directing elements. Thus an input fluid flow is divided into a number of parallel partial flows which follow a respective spiral-shaped flow path through the tube, whereby a high heat exchanging capacity is achieved.





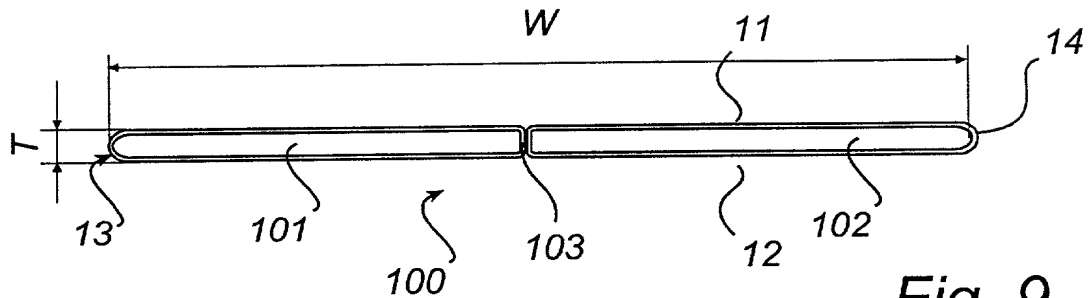


Fig. 9

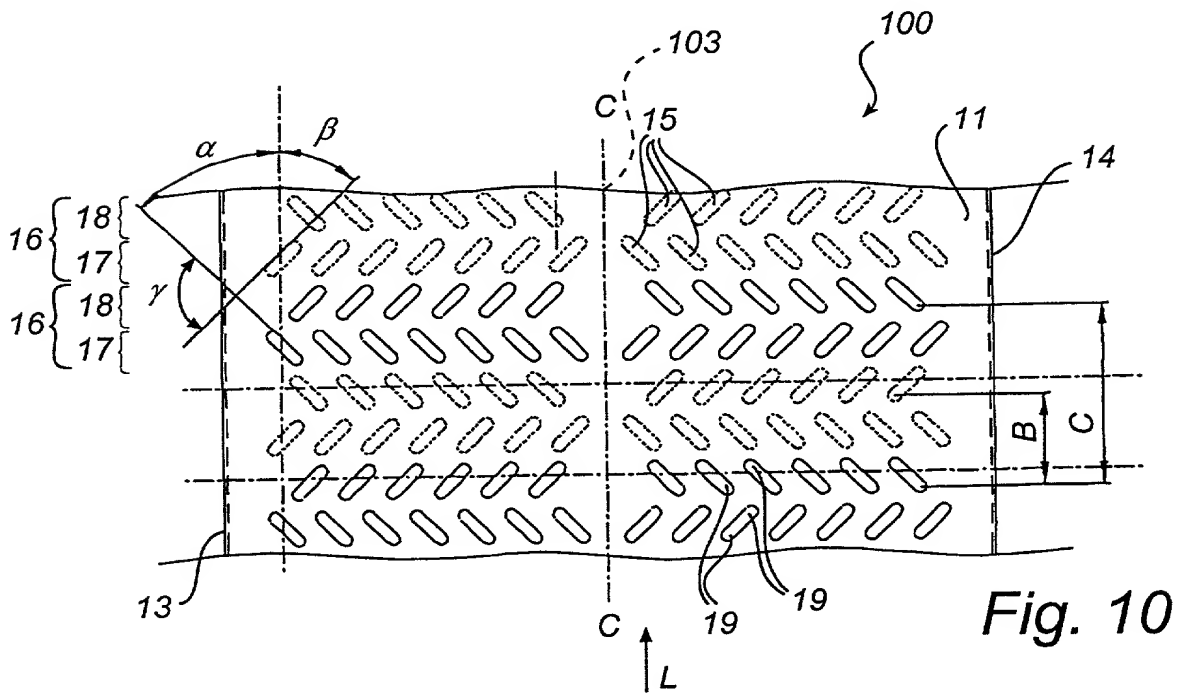


Fig. 10

COMBINED DECLARATION AND POWER OF ATTORNEY FOR
ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL
DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART APPLICATION

As a below name inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FLUID CONVEYING TUBE AND VEHICLE COOLER PROVIDED THEREWITH
the specification of which

a. ☒ is attached hereto

b. ☐ was filed on _____ as application Serial No. _____ and was amended on _____ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

c. ☐ was described and claimed in International Application No. _____ filed on _____ and as amended on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby specify the following as the correspondence address to which all communications about this application are to be directed:

SEND CORRESPONDENCE TO: MORGAN & FINNEGAN, L.L.P.
345 Park Avenue
New York, N.Y. 10154

DIRECT TELEPHONE CALLS TO: Joseph A. Calvaruso
(212) 758-4800

☐ I hereby claim foreign priority benefits under Title 35, United States Code § 119(a)-(d) or under § 365(b) of any foreign application(s) for patent or inventor's certificate or under § 365(a) of any PCT international application(s) designating at least one country other than the U.S. listed below and also have identified below such foreign application(s) for patent or inventor's certificate or such PCT international application(s) filed by me on the same subject matter having a filing date within twelve (12) months before that of the application on which priority is claimed:

☒ The attached 35 U.S.C. § 119 claim for priority for the application(s) listed below forms a part of this declaration.

<u>Country/PCT</u>	<u>Application Number</u>	<u>Date of filing (day, month, yr)</u>	<u>Date of Issue (day, month, yr)</u>	<u>Priority Claimed</u>
Sweden	9902326-9	18 June 1999		[x] YES [] NO
				[] YES [] NO
				[] YES [] NO

[] I hereby claim the benefit under 35 U.S.C. § 119(e) of any U.S. provisional application(s) listed below.

Provisional Application No.

Date of Filing (day, month, yr)

**ADDITIONAL STATEMENTS FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART
OR PCT INTERNATIONAL APPLICATION(S) (DESIGNATING THE U.S.)**

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or under § 365(c) of any PCT international application(s) designating the U.S. listed below.

<u>US/PCT Application Serial No.</u>	<u>Filing Date</u>	<u>Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)</u>

[] In this continuation-in-part application, insofar as the subject matter of any of the claims of this application is not disclosed in the above listed prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys and/or agents with full power of substitution and revocation, to prosecute this application, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith: John A. Diaz (Reg. No. 19,550), John C. Vassil (Reg. No. 19,098), Alfred P. Ewert (Reg. No. 19,887),

David H. Pfeffer (Reg. No. 19,825), Harry C. Marcus (Reg. No. 22,390), Robert E. Paulson (Reg. No. 21,046), Stephen R. Smith (Reg. No. 22,615), Kurt E. Richter (Reg. No. 24,052), J. Robert Dailey (Reg. No. 27,434), Eugene Moroz (Reg. No. 25,237), John F. Sweeney (Reg. No. 27,471), Arnold I. Rady (Reg. No. 26,601), Christopher A. Hughes (Reg. No. 26,914), William S. Feiler (Reg. No. 26,728), Joseph A. Calvaruso (Reg. No. 28,287), James W. Gould (Reg. No. 28,859), Richard C. Komson (Reg. No. 27,913), Israel Blum (Reg. No. 26,710), Bartholomew Verdirame (Reg. No. 28,483), Maria C.H. Lin (Reg. No. 29,323), Joseph A. DeGirolamo (Reg. No. 28,595), Michael P. Dougherty (Reg. No. 32,730), Seth J. Atlas (Reg. No. 32,454), Andrew M. Riddles (Reg. No. 31,657), Bruce D. DeRenzi (Reg. No. 33,676), Michael M. Murray (Reg. No. 32,537), Mark J. Abate (Reg. No. 32,527), Alfred L. Haffner, Jr. (Reg. No. 18,919), Harold Haidt (Reg. No. 17,509), John T. Gallagher (Reg. No. 35,516), Steven F. Meyer (Reg. No. 35,613), Kenneth H. Sonnenfeld (Reg. No. 33,285), Tony V. Pezzano (Reg. No. 38,271), Andrea L. Wayda (Reg. No. 43,979) and Walter G. Hanchuk Reg. No. (35,179) of Morgan & Finnegan, L.L.P. whose address is: 345 Park Avenue, New York, New York, 10154; and Michael S. Marcus (Reg. No. 31,727) and John E. Hoel (Reg. No. 26,279) of Morgan & Finnegan, L.L.P., Washington, D.C. 20006.

[] I hereby authorize the U.S. attorneys and/or agents named hereinabove to accept and follow instructions from _____ as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and/or agents and me. In the event of a change in the person(s) from whom instructions may be taken I will so notify the U.S. attorneys and/or agents hereinabove.

Full name of sole or first inventor Laszlo VALASZKAI

Inventor's signature* _____ date _____

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Citizenship Swedish

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Full name of second joint inventor, if any Esad CELIK

Inventor's signature* _____ date _____

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Citizenship Swedish

Post Office Address Hjortaskrocksvagen 1 J, 294 39 Solvesborg, Sweden

Full name of third joint inventor, if any _____

Inventor's signature* _____ date _____

Residence _____

Citizenship _____

Post Office Address _____

[] ATTACHED IS/ARE ADDED PAGE(S) TO COMBINED DECLARATION AND POWER OF ATTORNEY FORM FOR SIGNATURE BY FOURTH AND SUBSEQUENT INVENTORS

* Before signing this declaration, each person signing must:

1. Review the declaration and verify the correctness of all information therein; and
2. Review the specification and the claims, including any amendments made to the claims.

After the declaration is signed, the specification and claims are not to be altered.

To the inventor(s):

The following are cited in or pertinent to the declaration attached to the accompanying application:

Title 37, Code of Federal Regulation, § 1.56

Duty to disclose information material to patentability.

(a) A patent by its very nature is affect with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

Title 35, U.S. Code § 101

Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Title 35 U.S. Code § 102

Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent,
- (b) the invention was patented or described in a printed publication in this or foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States, or
- (c) he has abandoned the invention, or
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or
- (f) he did not himself invent the subject matter sought to be patented, or
- (g) before the applicant's invention thereof the invention was made in this country by another had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other ...

Title 35, U.S. Code § 103

Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed

invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Title 35, U.S. Code § 112 (in part)

Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms also enable any person skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Title 35, U.S. Code § 119

Benefit of earlier filing date in foreign country; right of priority

An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing.

Title 35, U.S. Code § 120

Benefit or earlier filing date in the United States

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 12 of this title in an application previously filed in the United States, or as provided by section 363 of this title, which is filed by an inventor or inventors named in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

Please read carefully before signing the Declaration attached to the accompanying Application.

If you have any questions, please contact Morgan & Finnegan, L.L.P.

FORM:COMB-DEC.NY
Rev. 1/00